



INVESTOR IN PEOPLE

The Patent Office
Concept House
Cardiff Road
Newport
South Wales
NP10 8QQ

REC'D 17 FEB 2004
WIPO PCT

I, the undersigned, being an officer duly authorised in accordance with Section 74(1) and (4) of the Deregulation & Contracting Out Act 1994, to sign and issue certificates on behalf of the Comptroller-General, hereby certify that annexed hereto is a true copy of the documents as originally filed in connection with the patent application identified therein.

In accordance with the Patents (Companies Re-registration) Rules 1982, if a company named in this certificate and any accompanying documents has re-registered under the Companies Act 1980 with the same name as that with which it was registered immediately before re-registration save for the substitution as, or inclusion as, the last part of the name of the words "public limited company" or their equivalents in Welsh, references to the name of the company in this certificate and any accompanying documents shall be treated as references to the name with which it is so re-registered.

In accordance with the rules, the words "public limited company" may be replaced by p.l.c., plc, P.L.C. or PLC.

Re-registration under the Companies Act does not constitute a new legal entity but merely subjects the company to certain additional company law rules.

Signed

Dated 6 February 2004

PRIORITY DOCUMENT
SUBMITTED OR TRANSMITTED IN
COMPLIANCE WITH
RULE 17.1(a) OR (b)

16 JAN 2003

NEWPORT

20JAN03 E778144-3 D02748
F01/7700 0.00-0501167.3**Request for grant of a patent**

(See the notes on the back of this form. You can also get an explanatory leaflet from the Patent Office to help you fill in this form)

The Patent Office

 Cardiff Road
 Newport
 South Wales
 NP10 8QQ

1. Your reference

P0788

2. Patent application number

(The Patent Office will fill in this part)

0301167.3

3. Full name, address and postcode of the or of each applicant (*underline all surnames*)

Ceramaspeed Limited

Zortech Avenue

Oldington

Kidderminster

Worcestershire DY11 7DY

Patents ADP number (*if you know it*)4428439002
United Kingdom

If the applicant is a corporate body, give the country/state of its incorporation

4. Title of the invention

TEMPERATURE-LIMITING DEVICE

5. Name of your agent (*if you have one*)

"Address for service" in the United Kingdom
to which all correspondence should be sent
(including the postcode)

DEREK JACKSON ASSOCIATES

 The Old Yard, Lower Town
 Claines
 Worcester WR3 7RY
Patents ADP number (*if you know it*)

560416002

6. If you are declaring priority from one or more earlier patent applications, give the country and the date of filing of the or of each of these earlier applications and (*if you know it*) the or each application number

Country

Priority application number
*(if you know it)*Date of filing
(day / month / year)

7. If this application is divided or otherwise derived from an earlier UK application, give the number and the filing date of the earlier application

Number of earlier application

Date of filing
*(day / month / year)*8. Is a statement of inventorship and of right to grant of a patent required in support of this request? *(Answer 'Yes' if:*

- a) *any applicant named in part 3 is not an inventor, or*
- b) *there is an inventor who is not named as an applicant, or*
- c) *any named applicant is a corporate body.*

See note (d))

yes

Patents Form 1/77

- Enter the number of sheets for any of the following items you are filing with this form.
Do not count copies of the same document

Continuation sheets of this form
Description 16

Claim(s)

Abstract

Drawing(s) 3 + 3 *Derek*

-
10. If you are also filing any of the following,
state how many against each item.

Priority documents

Translations of priority documents

Statement of inventorship and right
to grant of a patent (*Patents Form 7/77*)

Request for preliminary examination
and search (*Patents Form 9/77*)

Request for substantive examination
(*Patents Form 10/77*)

Any other documents
(please specify)

-
11. I/We request the grant of a patent on the basis of this application.

Signature

Date 17 Jan 2003

-
12. Name and daytime telephone number of
person to contact in the United Kingdom

Derek Jackson - Tel : 01905 755180

Warning

After an application for a patent has been filed, the Comptroller of the Patent Office will consider whether publication or communication of the invention should be prohibited or restricted under Section 22 of the Patents Act 1977. You will be informed if it is necessary to prohibit or restrict your invention in this way. Furthermore, if you live in the United Kingdom, Section 23 of the Patents Act 1977 stops you from applying for a patent abroad without first getting written permission from the Patent Office unless an application has been filed at least 6 weeks beforehand in the United Kingdom for a patent for the same invention and either no direction prohibiting publication or communication has been given, or any such direction has been revoked.

Notes

- If you need help to fill in this form or you have any questions, please contact the Patent Office on 08459 500505.
- Write your answers in capital letters using black ink or you may type them.
- If there is not enough space for all the relevant details on any part of this form, please continue on a separate sheet of paper and write "see continuation sheet" in the relevant part(s). Any continuation sheet should be attached to this form.
- If you have answered 'Yes' Patents Form 7/77 will need to be filed.
- Once you have filled in the form you must remember to sign and date it.
- For details of the fee and ways to pay please contact the Patent Office.

TEMPERATURE-LIMITING DEVICE

This invention relates to a temperature-limiting device for an electric heater, in particular an electric heater
5 for use in a cooking appliance, such as a cooking hob having a glass-ceramic cooking surface. The invention also relates to an electric heater provided with the temperature-limiting device.

10 It is well known to provide a temperature-limiting device for an electric heater. Such an electric heater is typically arranged for location behind a surface to be heated, such as a glass-ceramic cooking surface, and generally comprises a dish-like support having therein at
15 least one electric heating element. In particular, the temperature-limiting device comprises thermally responsive bimetallic means provided in a housing and supported on the heater in such a way as to respond, at a particular temperature of the heater, to operate one or
20 more switch means located in the housing.

It is necessary to electrically connect a voltage source to the heating element or elements and to arrange for the temperature-limiting device to operate to interrupt the
25 voltage supply when a predetermined temperature is reached.

It is known to provide a terminal block externally on the dish-like support of the heater. Such terminal block is connected to terminal regions of the heating element or elements and external leads are arranged from the 5 terminal block to the voltage source and to the temperature-limiting device. Such an arrangement is inconvenient and expensive to implement.

It is also known to provide direct electrical connection. 10 between terminal regions of a heating element and connecting elements on a temperature-limiting device, such connecting elements being accessible in the region of a front face of a housing of the temperature-limiting device adjacent to the heater. In this known 15 arrangement, the temperature-limiting device comprises a differentially-expanding rod and tube assembly, which extends at least partly across the heater from the housing and operates one or more switch means located in the housing.

20

According to the present invention there is provided a temperature-limiting device for an electric heater, the heater being adapted for location behind a surface to be heated and comprising a dish-like support having therein 25 at least one electric heating element having first and second terminal regions, the device comprising thermally

responsive bimetallic means provided in a housing, the housing being adapted to be supported at a peripheral region of the heater, at least partially externally of the dish-like support, the thermally responsive
5 bimetallic means being adapted to be thermally coupled with the heater to sense heat generated therein by the at least one heating element and to respond at a predetermined temperature to operate at least one switch means located in the housing, the housing having first
10 and second opposite sides provided with first and second electrically conductive elements accessible at the sides of the housing, externally of the dish-like support, for electrical connection to the first and second terminal regions respectively of the at least one electric heating
15 element.

Electrical connection of the first and second electrically conductive elements to the respective first and second terminal regions of the at least one heating
20 element may be by means of direct contact between the electrically conductive elements and the terminal regions.

Alternatively, one or both of the first and second
25 electrically conductive elements may be arranged for electrical connection to the respective first and/or

second terminal regions of the at least one heating element by way of at least one electrically conductive link, such as of wire or strip form.

- 5 The first and second terminal regions of the at least one heating element, or the at least one electrically conductive link, may extend through apertures in the dish-like support for electrical connection to the first and second electrically conductive elements.

10

The first and second terminal regions of the at least one heating element, or the at least one electrically conductive link, may be electrically connected to the first and second electrically conductive elements by

15 welding.

The first and second electrically conductive elements may extend laterally at the first and second opposite sides of the housing.

20

At least one of the first and second electrically conductive elements may have a portion extending in a direction towards the heater and at a predetermined angle relative to a rim of the dish-like support.

25

At least one of the first and second electrically conductive elements may be provided with a strip-like portion or a flanged portion for securing to the first and/or second terminal regions of the at least one

5 heating element, or to the at least one electrically conductive link.

The strip-like portion or portions may have a plane thereof disposed in any desired orientation from a

10 vertical plane to a horizontal plane.

The flanged portion may suitably have a wall portion with a dependant laterally-directed ledge portion.

15 The at least one electric heating element may be of corrugated ribbon form supported upstanding on edge in the dish-like support.

The first and second terminal regions of the at least one

20 electric heating element of corrugated ribbon form may be connected directly to the first and second electrically conductive elements and have an orientation substantially the same as that of the at least one electric heating element as supported in the dish-like support, or may be

25 twisted through an appropriate angle for connection to the first and second electrically conductive elements.

The first and second electrically conductive elements may comprise metal, such as stainless steel or nickel-plated steel.

- 5 The first electrically conductive element may be electrically connected to the at least one switch means in the housing and the second electrically conductive element may be adapted for electrical connection to an external lead wire.

10

-
- At least a third electrically conductive terminal may be provided at the first or second sides of the housing, and may be arranged for electrical connection to the at least one switch means in the housing and may be adapted for
- 15 electrical connection to an external lead wire.

The housing of the temperature-limiting device may comprise ceramic material.

- 20 The thermally responsive bimetallic means may be thermally coupled with the heater by means of an elongate thermally conductive member, such as of metal, and such as of rod, beam or tube form, which is adapted to extend from the housing at least partly across the heater and
- 25 overlying the at least one heating element. Such

elongate member may have an end thereof in direct or
indirect contact with the bimetallic means.

Alternatively, the housing may have a front face thereof
5 adapted to be exposed to thermal radiation from the
heater, through an aperture provided in a rim of the
dish-like support, the bimetallic means being either
adapted to be directly exposed to the thermal radiation
from the heater, or to be in thermo-conducting
10 relationship with thermally conducting means directly
exposed, at the front face of the housing, to the thermal
radiation from the heater.

The housing may be adapted to be partly inserted into the
15 heater through the aperture provided in the rim of the
dish-like support.

The bimetallic means may comprise a snap disc, operating
at a predetermined temperature to displace electric
20 contacts of the at least one switch means. The snap disc
may operate to displace the electric contacts by way of
an intermediate member, such as of rod form.

Alternatively, the bimetallic means may comprise a
25 member, such as of strip form, which undergoes increasing
deflection with increasing temperature and operates to

cause displacement of electric contacts of the at least one switch means at a predetermined temperature. Such electric contacts may be incorporated in a snap switch arrangement.

5

The present invention also provides an electric heater provided with the aforementioned temperature-limiting device.

10 For a better understanding of the present invention and to show more clearly how it may be carried into effect, reference will now be made, by way of example, to the accompanying drawings in which:

15 Figure 1 is a plan view of an arrangement of part of an electric heater provided with an embodiment of a temperature-limiting device according to the present invention;

20 Figure 2 is a plan view of a modification of the arrangement of Figure 1; and

Figure 3 is a plan view of an arrangement of part of an electric heater provided with an alternative embodiment
25 of a temperature-limiting device according to the present invention.

Referring to Figure 1, an electric heater 2 is arranged for location beneath a surface 4 to be heated. The surface 4 may be a cooking surface and may comprise glass-ceramic material.

5

The heater 2 comprises a dish-like support 6, such as of metal, containing a layer 8 of thermal and electrical insulation material, such as microporous thermal and electrical insulation material. A peripheral wall 10 of 10 thermal insulation material is provided in the dish-like support 6 and contacts the underside of the surface 4 to be heated.

At least one radiant electric heating element 12 is 15 arranged inside the dish-like support 6. As shown in Figure 1, heating element 12 comprises a corrugated metal ribbon arranged upstanding on edge in the dish-like support 6. However, other forms of heating element could be provided.

20

A temperature-limiting device 14 is provided for the heater 2 and comprises a housing 16, suitably of ceramic material, incorporating at least one switch means 18 having switch contacts 20. The housing 16 is secured to 25 the periphery of the heater 2, against or adjacent to a rim of the dish-like support 6.

A thermally responsive bimetallic means 22, in the form of a snap disc, is provided inside the housing 16 and is arranged to operate the switch means 18 by way of a rod 24, to open and close the switch contacts 20.

5

An elongate thermally conductive member 26 has an end 28 thereof thermally coupled directly or indirectly with the bimetallic snap disc 22 and extends from a front face 30 of the housing 16, through the rim of the dish-like support 6 and the peripheral wall 10 and at least partly across the heater 2, overlying the at least one heating element 12. The elongate thermally conductive member 26 comprises metal and is suitably in the form of a rod, beam or tube.

15

The housing 16 has a first side 32 from which laterally extends a first electrically conductive element 34 having a portion 36 extending in a direction towards the heater at a predetermined angle relative to the rim of the dish-like support 6. The first electrically conductive element 34 is electrically connected to the switch means 18.

The housing 16 has a second side 38 from which laterally extends a second electrically conductive element 40 having a portion 42 extending in a direction towards the

heater at a predetermined angle relative to the rim of the dish-like support 6. The second electrically conductive element 40 is provided with a terminal portion 44 for electrical connection to an external lead wire 5 (not shown), from a power supply.

A third electrically conductive element 46 is also provided on the housing 16 and extending laterally at the second side 38 thereof. This third electrically conductive element 46 is also electrically connected to the switch means 18 and is adapted to be connected to a further external lead wire (not shown), from the power supply.

15 The first, second and third electrically conductive elements 34, 40 and 46 are accessible at the sides 32, 38 of the housing 16 and suitably comprise metal, such as stainless steel or nickel-plated steel. They are suitably of strip form.

20

The corrugated ribbon heating element 12 has first and second terminal regions 12A and 12B thereof extending through apertures 48, 50 in the peripheral wall 10 and the rim of the dish-like support 6, of the heater 2. If 25 desired, the terminal regions 12A and 12B need not be corrugated. The first terminal region 12A of the heating

element 12 is welded directly to the portion 36 of the first electrically conductive element 34 and the second terminal region 12B of the heating element 12 is welded directly to the portion 42 of the second electrically 5 conductive element 40. The first and second electrically conductive elements 34, 40 are readily accessed at the sides 32, 38 of the housing 16 by the jaws of a pincer welding apparatus (not shown), to effect the necessary welding operations.

10

The portions 36 and 42 of the first and second electrically conductive elements 34, 40 may comprise wall portions and have dependant outwardly-directed ledge portions 36A and 42A respectively, such that the first 15 and second electrically conductive elements 34, 40 have a resultant flanged form. The ledge portions 36A and 42A serve to support the first and second terminal regions 12A, 12B of the heating element 12 during the welding operation and may each be provided with an upstanding lip 20 (not shown) on the outer edge thereof to assist retention of the terminal regions 12A, 12B on the ledge portions 36A, 42A prior to welding. The lips may extend upwardly by about 2mm and such that they do not inhibit access by the welding apparatus. Alternatively, other means (not 25 shown) may be provided to retain the terminal regions 12A, 12B on the ledge portions 36A, 42A prior to welding.

The portions 36 and 42 of the first and second electrically conductive elements 34, 40 could be of simple strip form, having a plane thereof disposed in any desired orientation from a vertical plane to a horizontal 5 plane.

When the heater 2 is energised for operation, heat is conducted along the elongate thermally conductive member 26 to the bimetallic snap disc 22. When a predetermined 10 temperature is reached, the snap disc 22 deflects and the rod 24 is urged towards the switch means 18, resulting in opening of the switch contacts 20 and de-energising of the heater. When the heater cools, the bimetallic snap 15 disc returns to its original state, allowing the switch contacts 20 to close and the heater to be energised again.

As shown in Figure 1, the first and second terminal regions 12A, 12B of the corrugated ribbon heating element 20 12 have an orientation substantially the same as that of the heating element 12 as supported in the dish-like support 6. If desired, however, the first and/or second terminal regions 12A, 12B of the heating element 12 may 25 be twisted through an appropriate angle for connection to the first and/or second electrically conductive elements 34, 40 in a different plane. This is illustrated in

Figure 2, where the first terminal region 12A of the heating element 12 is twisted and welded to the outwardly-directed ledge portion 36A of the portion 36 of the first electrically conductive element 34. The second 5 terminal region 12B of the heating element 12 can be similarly arranged.

Instead of the first and second terminal regions 12A, 12B of the heating element 12 being directly welded to the 10 first and second electrically conductive elements 34, 40, one or more intermediate electrically conductive links, such as of wire or strip form, may be provided connecting the first and/or second terminal regions 12A, 12B of the heating element 12 to the first and/or second 15 electrically conductive elements 34, 40 respectively.

This is illustrated in Figure 2, where the second terminal region 12B of the heating element 12 is welded to one end of a link 52 inside the heater 2. The link 52 passes through aperture 50 in the peripheral wall 10 and 20 the rim of the dish-like support 6 of the heater 2 and is welded at its opposite end to the portion 42 of the second electrically conductive element 40. The first terminal region 12A of the heating element 12 can be similarly treated.

The provision of one or more electrically conductive links, such as the link 52, is particularly advantageous when a heating element of lamp form is provided and where terminals on an envelope of the lamp cannot be connected directly to the first and second electrically conductive elements 34, 40.

Referring now to Figure 3, this shows an electric heater 2 provided with a temperature-limiting device 14 and which is constructed in substantially identical manner to that of Figure 1, with the exception of the operating components of the temperature-limiting device 14. In the arrangement of Figure 3, the thermally responsive bimetallic means 22 comprises a bimetallic strip secured at one end 22A to the housing 16 and has a free end 22B which gradually displaces or creeps in a direction towards the switch means 18 as its temperature increases. Such displacement or creeping is transmitted by the rod 24 to the switch means 18. Here the switch means 18 comprises a snap switch arrangement and, at a particular displacement or extent of creeping with temperature of the bimetallic strip 22, the contacts 20 of the switch means 18 snap open, resulting in de-energising of the heater 2. On cooling, the bimetallic strip 22 gradually returns to its original position and the contacts 20 of

the switch means 18 snap shut, allowing further energising of the heater 2.

Although an elongate thermally conductive member, such as 5 the member 26 of Figure 1, could be provided to conduct heat generated in the heater 2 to the bimetallic strip 22, this is not essential. As shown in Figure 3, the front face 30 of the housing 16 is arranged to be exposed to thermal radiation from inside the heater 2 through an 10 aperture 54 provided in the peripheral wall 10 and the rim of the dish-like support 6. If desired, the housing 16 could be partly inserted into the aperture 54.

The front face 30 of the housing 16 may be provided with 15 an aperture to expose the bimetallic strip 22 to thermal radiation from within the heater 2, or may comprise or include a thermally conductive material thermally coupled to the bimetallic strip 22.

20 The alternative arrangements, shown in Figure 2, for connecting the terminal regions 12A, 12B of the heating element 12 to the first and second electrically conductive elements 34, 40, are also equally applicable to the heater 2 of Figure 3.

1 | 3

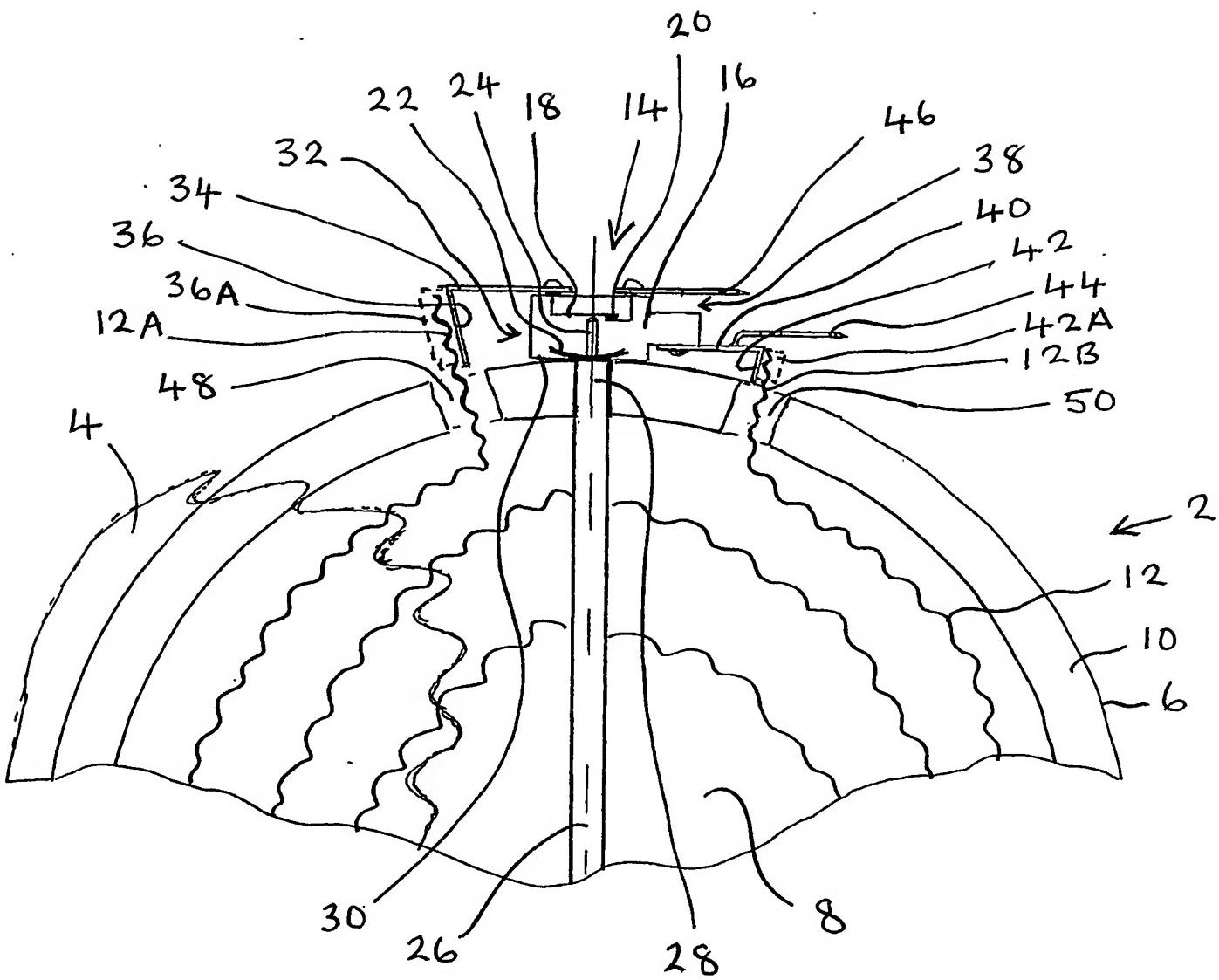


FIG. 1

2 / 3

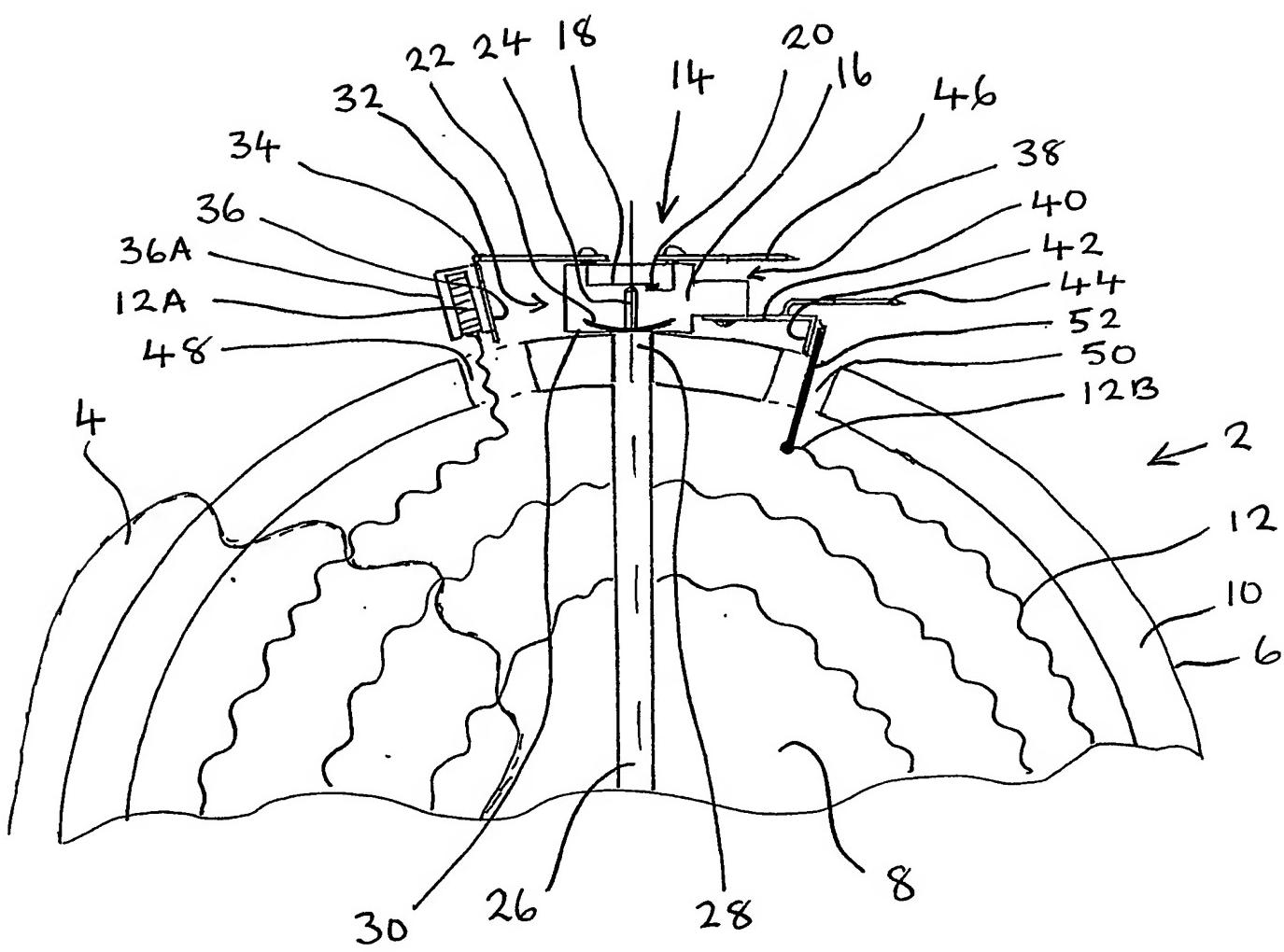


FIG. 2

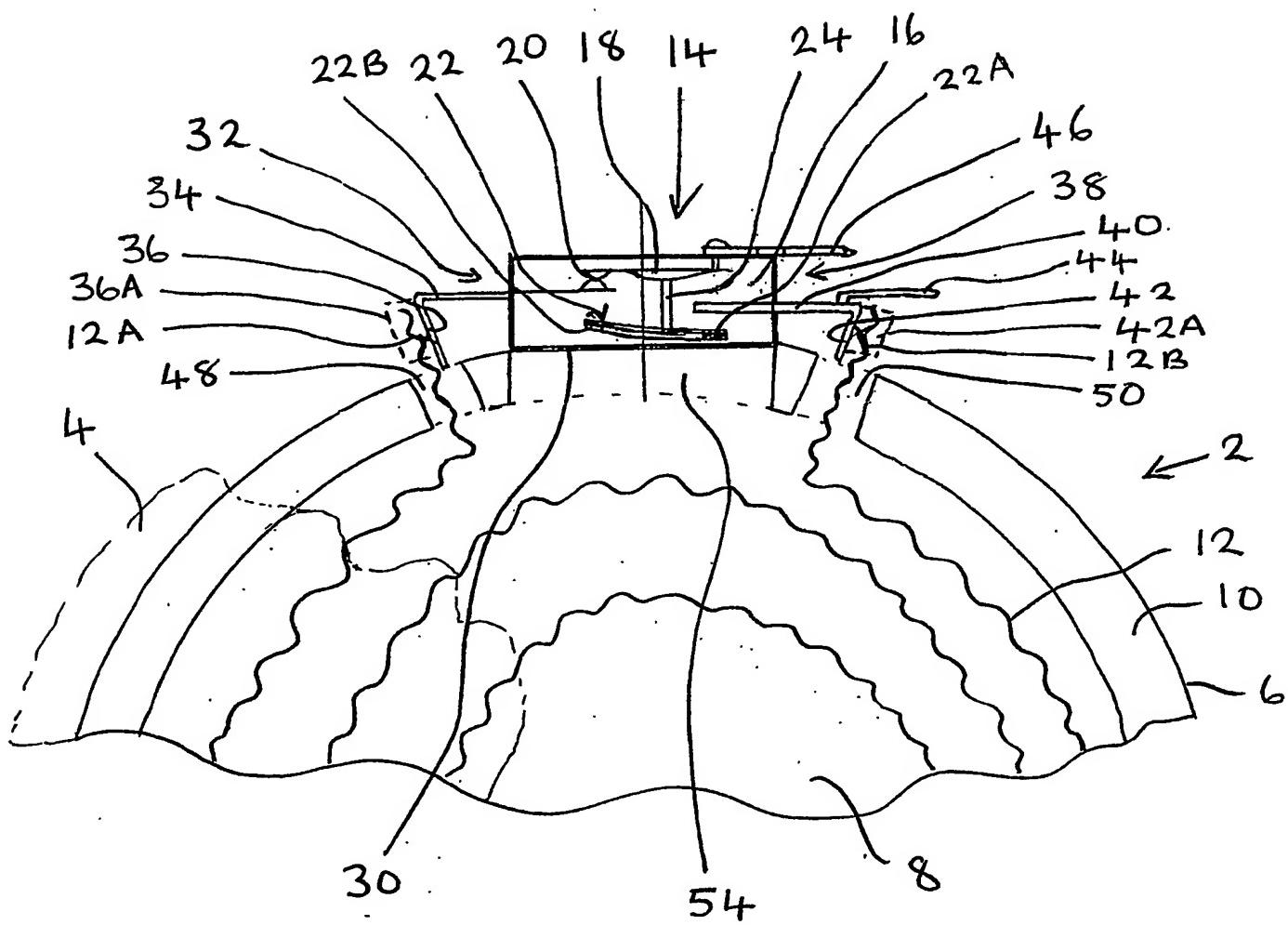
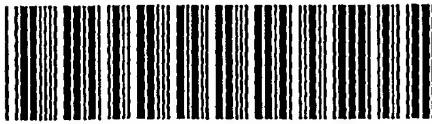


FIG. 3

PCT Application

PCT/GB2004/000178



**This Page is Inserted by IFW Indexing and Scanning
Operations and is not part of the Official Record**

BEST AVAILABLE IMAGES

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images include but are not limited to the items checked:

- BLACK BORDERS**
- IMAGE CUT OFF AT TOP, BOTTOM OR SIDES**
- FADED TEXT OR DRAWING**
- BLURRED OR ILLEGIBLE TEXT OR DRAWING**
- SKEWED/SLANTED IMAGES**
- COLOR OR BLACK AND WHITE PHOTOGRAPHS**
- GRAY SCALE DOCUMENTS**
- LINES OR MARKS ON ORIGINAL DOCUMENT**
- REFERENCE(S) OR EXHIBIT(S) SUBMITTED ARE POOR QUALITY**
- OTHER:** _____

IMAGES ARE BEST AVAILABLE COPY.

As rescanning these documents will not correct the image problems checked, please do not report these problems to the IFW Image Problem Mailbox.